



## NASA STTR 2014 Phase I Solicitation

### T12.03 Additive Manufacturing of metal Plus Insulator Structures with sub-mm Features

Lead Center: GSFC

NASA is interested in investigating additive manufactured structures combining metals and insulators demonstrating multiple layers of 10-500  $\mu\text{m}$  lines and spaces, 200  $\mu\text{m}$  thick insulator layers, and 200  $\mu\text{m}$  diameter blind vias on 400  $\mu\text{m}$  centers capable of withstanding  $\sim 800$  V between layers.

Expected Deliverables: Fabrication of a small area, few  $\text{cm}^2$ , micro-well detector with 200  $\mu\text{m}$  diameter holes, 200  $\mu\text{m}$  deep, on 400  $\mu\text{m}$  centers that operates up to  $\sim 800$  V. Demonstration of scalability to large,  $\sim 1$   $\text{m}^2$ , area.

Mission Traceability: The Advanced Energetic Pair Telescope (AdEPT), a medium energy gamma-ray polarimeter.

Beyond the initial medium-energy gamma-ray instrument application, NASA foresees a wide range of further scientific space instruments enabled by additive manufacturing (3-D printing) that combines metals and insulators with sub-mm feature sizes. Possibilities include fabrication of electro-mechanical structures for ionization detectors, mass spectrometers, charged particle detectors et cetera for both small and large scale space missions.

In addition, this is a generic technology which would also be suitable for fabrication of commercial grade, micro-scale electronics.

State of the Art: Additive manufacturing with metals or insulators (plastics) is advancing rapidly. SOA is limited in feature size, inability to combine metals and insulators, and surface smoothness needed for high voltage applications. 3-D additive manufacturing that combines insulators and conductors is being pursued by several entities. Combining metals and insulators with sub-mm features would provide significant improvements in performance and size of the micro-well detectors for AdEPT. Current micro-well fabrication using laser micro-machining requires RIE post processing to eliminate residue from laser ablation that leads to high voltage breakdown in the micro-wells.